AUSTRALIAN BLEPHAROCERIDAE.

(ORDER DIPTERA). PART 1:—DESCRIPTION OF NEW SPECIES.

By R. J. Tillyard, M.A., Sc.D. (Cantab.), D.Sc. (Sydney), C.M.Z.S., F.L.S., F.E.S., Entomologist and Chief of the Biological Department, Cawthron Institute, Nelson, N.Z.

(With two Plates and seven Text-figures.)

The Blepharoceridae or Net-veined Midges are an archaic family of Nemocerous Diptera highly specialised for life in all stages on or about waterfalls and cascades. The eggs are laid singly on the faces of rocks permanently wetted with the spray of the falls, and the larva passes its whole life either in the same situations, or actually sticking to the rocks over which the water rushes. In order to be able to do this, it is provided with a set of six conspicuous mid-ventral suckers. The pupa is a black, oval object, attached firmly to the rock beneath the rushing water by three pairs of pads on its flat ventral surface, and breathing by means of two conspicuous prothoracic respiratory processes, each formed of four lamellae. The imagines have very long, slender hindlegs, and cling to the wet rocks with all six legs spread widely out. Their wings are held out at right angles to the body and in line with one another; this habit enables the collector at once to distinguish a Blepharocerid from various forms of Tipulidae which frequent similar situations, but which always rest with the wings folded down the abdomen. The secondary net-veining (Text-fig. 1) which is peculiar to this family has nothing to do with the true venation, but represents the creases formed in the wings while folded up in the pupa. It seems to have arisen because of the necessity for the imago to emerge with the greatest possible speed in order to avoid being swept away by the rushing waters; consequently, the wing has to become fully developed within the pupal shell before the imago discloses itself, and these secondary creasings are the result. Other characters of importance for the family are the frequent occurrence of holoptic eyes, and of eyes divided transversely by a non-facetted line or band into two portions, the upper of which has facets of a larger size and a different colour from those of the lower, thus closely resembling the similar eyes to be found in Ascalaphidae and certain Dragonflies. The mouth-parts are formed for piercing, particularly in the case of the females, which are furnished with long spear-like mandibles, absent in the males. The hypopygium of the males resembles that of Mecoptera and of certain Tipulidae, there being no secondary rotation of the terminal tergites and sternites through 180°, as in Psychodidae and Culicidae. The so-called superior appendages are not true appendages, but processes from the ninth ter-

gite; the longer inferior appendages, forming the forceps, are the distal segments of the gonapophyses of the ninth sternite, the basal segments forming the "side-pieces" or bases of the forceps, while the true ninth sternite is reduced to a narrow ring. A penis and a pair of penunci are also present, though mostly hidden between the upper processes and the forceps. In the female, the abdomen ends in a pair of short appendages, while the ninth sternite bears a pair of small gonapophyses, unsegmented.

A constant feature in the wings of this family is the general shape of the wing, which is petiolate at the base, the narrow portion being called the *petiole* or *pedicel,* and then widens out suddenly by enlargement of the anal margin, so that a deep re-entrant angle is formed between the pedicel and the rest of the wing; this is called the *axillary lobe.* The anal margin then becomes strongly bent into a projecting angle, generally a right-angle or slightly obtuse, more rarely somewhat acute, and called the *anal angle.* Closely allied species may have considerable differences in the form of this angle as reliable specific characters.

The venation of most Blepharoceridae is so reduced that the naming of the veins has until recently been open to considerable doubt. But the discovery, in Southern Chile and Patagonia, of the archaic genus *Edwardsina,* recently described by Alexander, has definitely solved this problem; for, in this genus, the venation is complete enough to enable all the main veins to be named with certainty, as may be seen from Text-fig. 1, *a.*

Though abundant enough in New Zealand, from which region four species have already been described and others still await description, yet the record of the occurrence of Blepharoceridae in Australia rested until recently on a single specimen taken by Mr. F. P. Dodd at Kuranda, N. Queensland, and described by Professor Bezzi as *Apistomyia collini* in *Bull. Soc. Entom. Ital.,* xliv. (1912), 1913, pp. 67-69. Having collected these interesting insects abundantly in many parts of New Zealand, and being familiar with their peculiar life-histories, it occurred to me that their apparent absence in such places as the Blue Mountains of N.S.W. might be explained most satisfactorily by the fact that they had been consistently overlooked by collectors, rather than that they were actually absent from such favourable localities. Therefore, on a recent visit to Sydney, I determined to make special search for them. This search was rewarded by my finding, on the very first day of my visit to Wentworth Falls, numerous larvae and pupae of a Blepharocerid on and around the Weeping Rock. On the following day, which was sunny, imagines of both sexes of this new species were taken in the same locality. A week or two later, while on a visit to Mount Kosciusko, two fine new species were secured, together with larvae and pupae. Thus the total number of species for Australia has already been brought up to four as the result of only a few days collecting in suitable localities. It would seem reasonable to suppose that many more species of these interesting flies remain to be discovered throughout Tasmania, where waterfalls are plentiful, and also in the mountainous parts of the Australian mainland.

The present paper will deal only with the imagines of the newly discovered species. Later on, I hope to give, in a second paper, full descriptions of the larvae and pupae, together with some account of their habits, and a discussion of the value of the larval characters as guides to generic affinities.

The three species here described belong to three different genera, viz., *Edwardsina* Alex., *Neocurupira* Lamb. and *Apistomyia* Bigot. The first of these has only been previously recorded from Southern Chile and Patagonia, so that the existence of such an archaic type on Mount Kosciusko is striking additional evidence on the question of ancient land-connections between Southern land-

masses of the present day. In all stages of their life-history, Blepharoceridae are dependent on the rushing water and spray of waterfalls, and are quite unable to exist for more than a very short time without these. Hence their distribution cannot have been brought about by sea or air carriage, but must have taken place along definite land routes marked by the frequent occurrence of running streams; and this, of course, indicates land of a mountainous nature. The morphology of the family would indicate for it an origin in either Liassic or Upper Jurassic times. Thus the presence of a species of *Edwardsina* on Mount Kosciusko is best explained by the Antarctic Theory, which postulates that, at some ancient time or other, but not necessarily at the same time, Australia and Tasmania together, and New Zealand and Patagonia separately, were all linked with the Antarctic Continent when it enjoyed a temperate climate, and thus allowed of the passage of many types of plants and insects from one to the other of these regions. If this theory be correct, it may reasonably be expected that another species of *Edwardsina,* or of some closely allied new genus, will be discovered in the high mountains of Tasmania.

The other genus discovered on Mount Kosciusko is *Neocurupira* Lamb., found only hitherto in New Zealand, and also related to *Curupira* from Brazil. This genus also may be expected to occur in Tasmania. It is considerably more highly specialised than *Edwardsina.*

The genus *Apistomyia* Bigot, to which the new species found at Wentworth Falls belongs, is represented by species found in Corsica, Cyprus, the Himalayas and North Queensland, and will probably be found to exist in all suitable localities right through the Oriental Region and across to New Guinea as well as down the Eastern Coast of Australia. It is absent from New Zealand, Camphell's *Apistomyia harrisi,* recently described, (*Trans. N.Z. Inst.,* liii., 1921, p. 262), being undoubtedly a true *Peritheates,* and this latter genus being so far unknown outside New Zealand. It is more highly specialised than *Neocurupira.* Thus, as we pass from South to North along the Eastern ranges of Australia, we meet first with the more archaic types, and then with the more highly specialised. This, again, suggests a Southern origin for the family in Australia. New Zealand, likewise, on present evidence, has only received types from the South; and the comparative much greater abundance of these insects in the South Island than in the North also bears this out.

Bezzi has divided the family Blepharoceridae into four subfamilies, I have not adopted these, and do not think it necessary to discuss them, as it seems to me very clear that such divisions are very unwise in the present state of our knowledge, and that much more work needs to be done on the family before the main lines of evolution within it can be made clear. Until that is done, preconceived opinions of relationships of genera, based on their supposedly belonging to one or other of Bezzi's subfamilies, only prevent a clear view of the field, and are apt to bias or predispose one's judgment in the matter. What is perfectly clear is that *Edwardsina* is easily the most archaic genus so far discovered, and that the archetype of the family was not far removed from this type. Consequently, all known genera can be derived from a type not unlike *Edwardsina*; but how many separate lines of descent there are actually represented by living forms at the present day, we cannot say for certain. A careful study of larval and pupal characters may help us to solve this problem; but the principal characters for each genus must always be drawn from the imago, as has hitherto been done by all workers in the group.

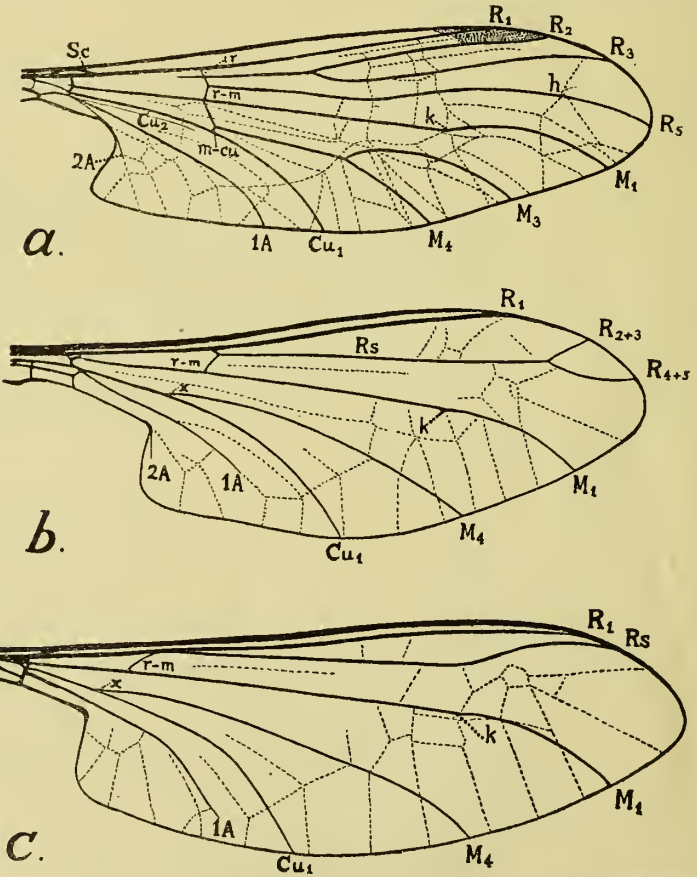
In the following Key to the Genera, I include the New Zealand genus *Peritheates* Lamb, as it seems likely that it too may yet be discovered in Australia or Tasmania.

KEY TO THE GENERA OF BLEPHAROCERIDAE FOUND IN AUSTRALIA, WITH THE ADDITION OF *PERITHEATES* Lamb.

(1) Maxillae with long, four- to five-segmented palpi; antennae long; eyes not divided transversely into upper and lower portions; wings with Rs and M both three-branched . . . . . EDWARDSINA Alex.
Maxillae with short, one- to two-segmented palpi; antennae short; eyes divided transversely into upper and lower portions; wings with Rs simple or having a terminal fork, media with only M_1 and M_4 present . . . . 2.

(2) Rs with a terminal fork . . . . . NEOCURUPIRA Lamb.
Rs simple . . . . . 3.

(3) Rs nearly straight, ending up far from R_1, just above apex. . . . . PERITHEATES Lamb.
Rs curving sharply upwards distally, so as to end up very close to R_1, far from apex . . . . . APISTOMYIA Bigot.



Text-fig. 1:—Wings of *a*, *Edwardsina australiensis* n.sp., ♂, (x 11), *b*, *Neocurupira nicholsoni* n.sp., ♂, (x 16), *c*, *Apistomyia tonnoiri*, n.sp., ♀ (x 21).

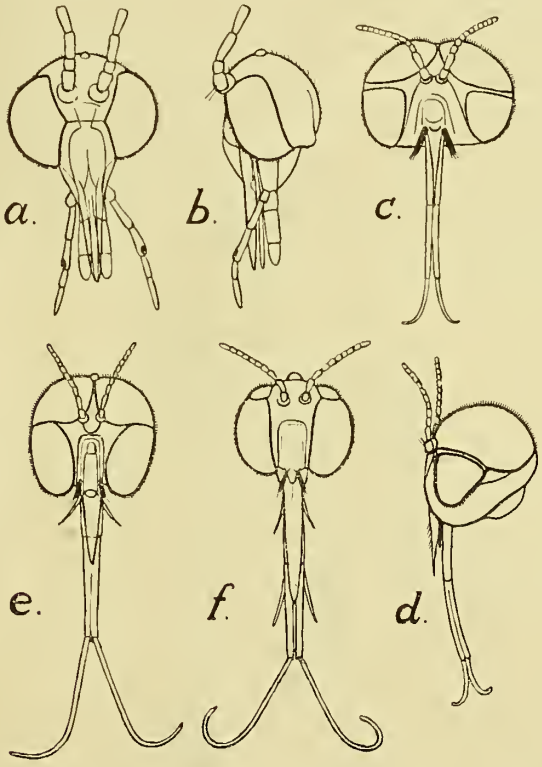
Genus EDWARDSINA Alex.

(Text-fig. 1, *a*.)

Alexander, C.P., *Arkiv för Zoologi*, Bd. 13, No. 7, 1920, p. 2.

Characters as given in the Key, with the following additions:—eyes dichoptic in both sexes; mandibles in the female rather broad, knife-shaped; labium of primitive Mecopterous form, with separate, two-segmented palps of broad form and with well rounded apices, forming a primitive type of labellum; all three pairs of legs long; wings with a long fork to R_{2+3}, M_2 indicated either by a stump-vein or a definite kink in M_{1+2}, M_{3+4} broadly forked distally, and connected basally with M_{1+2} by its original basal piece, as well as to Cu_1 by *m-cu*; pedicel short and anal angle prominent.

Genotype:—*E. chilensis* Alex. (Southern Chile and Patagonia).



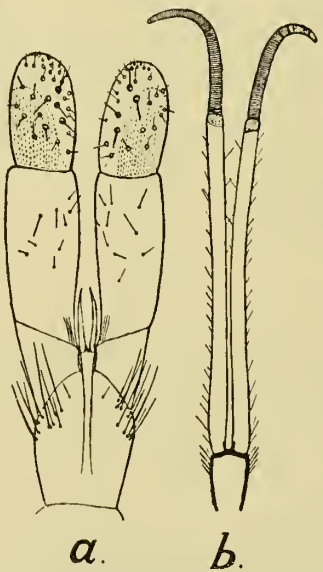
Text-fig. 2:—Heads of *a*, *Edwardsina australiensis* n.sp., ♀, (x 20), front view, *b*, the same, side view, *c*, *Neocurpira nicholsoni* n.sp., ♂, (x 20), front view, *d*, the same, side view, *e*, *Apistomyia tonnoiri* n.sp., ♂, (x 20), front view, *f*, the same species, ♀, front view.

EDWARDSINA AUSTRALIENSIS n.sp.

(Plates xliv., figs. 1, 2; xlv., figs. 1-7, *a*; Text-figs. 2, *a, b*; 3, *a*; 4).

♂. *Total length* 5, *abdomen* 3, *forewing* 9.5, *expanse* 20 mm.

H e a d small, subglobular, dull blackish in colour, with greyish pubescence. *Occiput* prominent; *vertex* with a small but conspicuous ocellar tubercle placed between the inner posterior angles of the eyes and surrounded by a pale raised ring. *Median ocellus* large, bright, facing forwards, *lateral ocelli* smaller, facing laterally outwards. *Eyes* dichoptic and undivided, separated from each other by the trapezium-shaped vertex, which narrows anteriorly to about the width of the ocellar tubercle; colour dull blackish. *Antennae* (Plate xlv., fig. 1 *a* and text-fig. 2, *a, b*) inserted fairly close together, 3.2 mm. long, with 15 segments; colour black; the two basal segments short and somewhat swollen, the rest longer, subcylindrical, somewhat flattened; the first segment carries two stiff bristles, the others only a very few short hairs; last four segments narrower than the rest, terminal segment somewhat pointed at apex. *Labrum-epipharynx* (Plate xlv., fig. 2 *a*) somewhat broader than usual in the family, the sides almost parallel, the tip broadly rounded, colour dark brown. *Hypopharynx* of about the same length as labrum, but narrower, the tip more pointed, the sides carrying minute barbs. *Mandibles* absent. *Maxillae* (Plate xlv., fig. 3, *a*) with long (1 mm.), five-segmented palpus, and with small, pale coloured, rather weakly formed galea, sharply pointed at apex; the palpus blackish, densely clothed with greyish hairs; first segment of palp very short, bulbous, closely attached to the palpiger; second segment long and slender; third not so long, somewhat enlarged distally, and carrying a conspicuous dark-coloured sense-organ (*so*) close up to apex on outer side; this sense organ is of oval shape, and appears to be divided into three



Text-fig. 3:—Labium of *a*, *Edwardsina australiensis* n.sp., ♀, (x 100), *b*, *Neocurupira nicholsoni* n.sp., ♂, (x 50).

sub-equal sectors; fourth segment slender cylindrical, two-thirds as long as second; fifth segment narrower and slightly longer than fourth, rounded at apex. *Labium* (Text-fig. 3*a*) not quite as long as labrum, of very primitive form, resembling that of certain Mecoptera; arising from a moderately broad basal piece (probably the mentum) there is a very narrow median lobe carrying two very small sharply pointed processes, representing the inner lobes; on either side of these lie the broad palpigers, from each of which arises a large two-segmented palpus of typical Mecopterous form, the basal segment being the larger and paler, somewhat less heavily chitinised than the apical, and carrying only small slender setae, while the apical segment has a broadly rounded tip and carries numerous short stiff sensory setae arising from wide circular bases; the two palpi, though separated for their entire lengths, clearly constitute a true *labellum* of primitive type.

Thorax of the usual shape for the family, the *prothorax* very small, the *mesothorax* greatly swollen, the *metathorax* small, with the *scutellum* in the form of a slightly projecting convex ridge. Colour velvety black with greyish pubescence; *scutellum* shining black. Sides of thorax dull blackish, with a pale testaceous area situated beneath the attachment of the wing on each side.

Legs all very long; coxae and trochanters very short, testaceous, each with a conspicuous tuft of stiff black hairs beneath it; femora, tibiae and tarsi very long, the hind femur stoutly built; colour black, except the bases of the femora, which are testaceous. Measurements as follows:—

Foreleg:—Femur 6, tibia 6, tarsus 5.8 mm.

Middle leg:—Femur 6, tibia 5.4, tarsus 5.2 mm.

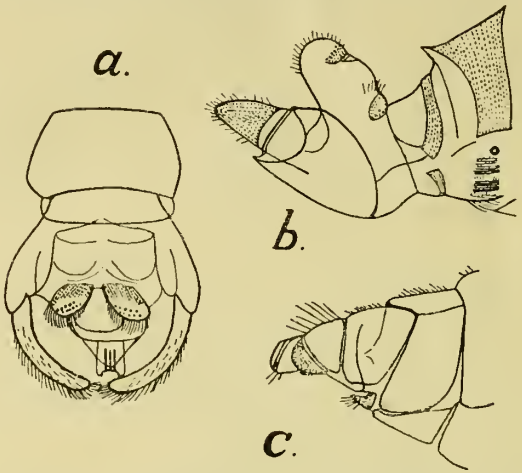
Hindleg:—Femur 8.5, tibia 8.5, tarsus 3.8 mm.

Middle and hind tibiae with a single long black spur (Plate xlv., fig. 5, *a*). *Hind tarsus* (Plate xlv., fig. 6, *a*.) with the basal segment as long as the other four plus the claws; length of segments in order, 1, 2, 5, 3, 4, (5 almost equal to 3); segs. 1-4 very narrow, cylindrical, 5 enlarged basally and slightly curved, its base beset with numerous stiff bristles, its outer margin hairy. *Tarsal claws* (Plate xlv., fig. 7, *a*.) curved, sharply pointed, carrying on the inner side four prominent teeth, of which the first is smaller than the others and placed close up to the second; *empodium* apparently very rudimentary.

Wings:—*Forewings* subhyaline, slightly infuscated all over, with black venation and a beautiful violet iridescence; pterostigma darkened. Venation and secondary net-veining as shown in Text-fig. 1, *a*. The wings differ from those of the genotype (*E. chilensis* Alex.) in being somewhat narrower in proportion to their length, with the anal angle more prominent, the fork of R_{2+3} placed further distad (half-way from base in *E. australiensis*, one-third from base in *E. chilensis*), the basal stump of Rs shorter, R_{4+5} originating immediately below *ir*, *m-cu* very short (almost obsolete in some specimens), the basal stump of M_2 absent, though the kink (*k*) in the vein M_{1+2}, at the point where M_2 originally came off, remains; Cu_2 is closer to Cu_1 than in *E. chilensis*, 1A diverges from Cu_1 distally, and 2A is complete from base to axillary lobe, and runs a little beyond it. At the point *h* in Text-fig. 1, *a*, there is, in a few specimens, a definite stump-vein projecting upwards and distad; this is evidently the stump of an original R_4, and indicates that the single vein hitherto taken to be R_{4+5} is, as far as its distal portion is concerned, really only R_5, R_4 having been eliminated. The posterior margin of the wing carries a fringe of fine hairs from base to apex, those on the pedicel being the longest.

Halteres 1.2 mm. long; pedicel slender, testaceous at base but darkening distally; club broadly spatulate, black, with a small area of pale testaceous basally.

Abdomen slender subcylindrical, the hypopygium distinctly upturned. Colour dull blackish above fading to brownish below. Each segment is furnished with a tuft of blackish hairs on either side.



Text-fig. 4:—*Edwardsina australiensis* n.sp. *a*, Hypopygium of ♂, dorsal view (x 50). *b*, the same, lateral view. *c*, end of abdomen of ♀ (x 20).

Hypopygium as shown in Text-fig. 4, *a*, *b*.

♀. Forewing 11.5, expanse 24.5 mm. Measurements of hindleg:—femur 9.7, tibia 9.7, tarsus 4 mm. Differs from the male as follows:—

The *head* (Text-fig. 2 *a*, *b*) is larger and more squarely shaped, the *occiput* very broad, as wide as the total width across the eyes, cut off squarely behind, but with the lateral posterior angles slightly rounded off. *Eyes* somewhat smaller than in male and separated by a somewhat wider space. (Text-fig. 2, *a*, *b*.). *Antennae* 2.8 mm. long. Margin of occiput behind eyes greyish white. *Mandibles* (Plate xlv., fig. 4, *a*) present, 1.3 mm. long, knife-shaped, with slightly nodding apex ending in a fine tooth; inner margin finely serrated for apical two-thirds of its length, the fine teeth all being turned backwards towards the base.

Abdomen tapering distally, broader than in male, ending in a pair of short appendages cut off obliquely as shown in Text-fig. 4, *c*; *gonapophyses* of seg. 9 very small, pointed, hairy.

Types:—♂ holotype, ♀ allotype, and series of paratypes of both sexes, in Cawthron Institute Collection, Nelson, N.Z. A pair of paratypes in British Museum of Natural History, London, and another pair in the Australian Museum, Sydney.

Habitat:—Waterfalls along Digger's Creek, from 4500 to 5500 feet, on Mount Kosciusko, N.S.W. Types taken at a little over 5000 feet on Nov. 25th, 1921, paratypes, Nov. 24th to 28th inclusive.

This remarkable insect occurs fairly abundantly wherever a small waterfall offers sufficient rush of water for the existence of its larvae and pupae. It clings to the edges of rocks over which the water is rushing, or to the damp moist surfaces of rocks and crevices placed so close to the main rush of water that they are drenched with the spray. Several pairs were seen *in cop.* in such

localities, and it seems certain that the eggs are laid also in similar places. A female placed inside a damp glass tube oviposited readily, the eggs being placed singly. The flies themselves are very tame, and can easily be caught either with a forceps or with the fingers, though they should be approached without unnecessarily irregular movements. The flight is ghostlike, and the insects are not easy to see as they drift up against the white foam of the waters. In sunlight, the violet iridescence of the wings is exceedingly beautiful, and often betrays the presence of the insect when clinging to a rock in the spray of a waterfall.

Larvae and pupae were abundant, but difficult to locate, owing to the dark colour of the granite rocks forming the bed of the creek. Numbers were finally collected by temporarily damming the stream so as to leave portions of the rocks nearly dry, and then picking the larvae and pupae off them.

The male of this fly is shown enlarged in Plate xliv., fig. 1, the female in fig. 2. One female was taken which expanded just an inch across the wings,—a large size for this family.

E. chilensis Alex. differs from *E. australiensis* n.sp. not only in the venational characters already mentioned, but also in having spurs 1, 2, 2 instead of 0, 1, 1. Alexander also says that the maxillary palps are 4-segmented, but he has probably overlooked the very short basal segment.

Genus NEOCURUPIRA Lamb.

Lamb, *Trans. N.Z. Inst.*, xlv., (1912), 1913, p. 72, figs. 1-5.

Characters as given in the Key on p. 162, with the following additions:—antennae 12- to 15-segmented; eyes holoptic in the male, dichoptic in the female; labium very long and narrow, with the distal segments of the labellum strongly divergent; fore and middle legs rather short, hind legs very long; spurs 0, 0, 2; anal angle of the wing prominent.

Genotype:—*Neocurupira hudsoni* Lamb, (Arthur's Pass, South Island of New Zealand).

NEOCURUPIRA NICHOLSONI n.sp.

(Plates xliv., fig. 3; xlv., figs. 1-3, 5-7, *b*; Text-figs. 2, *c*, *d*; 3 *b*; 5.)

♂. *Total length* 3, *abdomen* (shrivelled) 1.6, *forewing* 6, *expanse* 12.5 mm.

Head (Text-fig. 2 *c*, *d*.), large, black, globular, almost entirely occupied by the large *eyes*, which are bright green in life, dull blackish when dead, and often collapsed in the dried specimen; these eyes are holoptic, and each is divided transversely by a non-facetted band into two approximately equal portions, the upper having larger facets than the lower. A fringe of pale brown hairs borders the orbits above and behind. *Ocellar tubercle* small. *Antennae* (Plate xlv., fig. 1 *b*) inserted close together at the base of the narrow triangular vertex, short (0.8 mm.), black, 12-segmented, the two basal segments enlarged, the second club-shaped and longer than the first, 3 much shorter and narrower than 2, 4-7 each a little shorter than the one before it, 8-10 subequal, little longer than wide, 11 very short and closely attached to 12, which is longer, with well rounded tip carrying two stiff bristles. *Labrum-epipharynx* (Plate xlv., fig. 2 *b*) 0.6 mm. long, slender triangular, the tip sharply pointed. *Hypopharynx* about the same length, narrower, tip not so pointed. *Mandibles* absent. *Maxillae* (Plate xlv., fig. 3, *b*.) with a single-segmented palpus of same length as the galea (0.3 mm.), the palp subcylindrical with rounded apex, hairy, black, the galea very slender, sharply pointed, pale in colour. *Labium* (Text-fig. 3, *b*) very long (1.4 mm.), slender, black, projecting downwards one and a half times the whole diameter of the head; labellum with basal segments very long, closely approximated, distal segments shorter, their distal portions curving outwards.

Thorax velvety black, with two patches of slight greyish pubescence on either side of the mesonotum and a touch of brown just above the wings; *scutellum* black, convexly rounded.

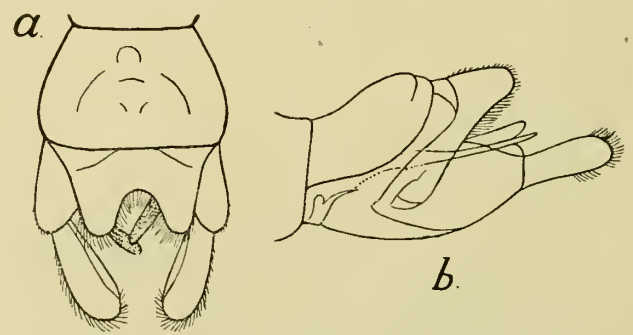
Legs:—Forelegs rather long, middle legs shorter, hindlegs very long. Coxae and trochanters short, brownish; femora, tibiae and tarsi long, the femora very slightly enlarged distally, brownish at base shading to blackish distally, tibiae and tarsi brownish. Measurements as follows:—

Foreleg:—Femur 1.5, tibia 2, tarsus 2.8 mm.
Middle leg:—Femur 1.5, tibia 1.5, tarsus 1.7 mm.
Hind leg:—Femur 3.4, tibia 3.4, tarsus 4 mm.

Fore and middle tibiae and tarsi very narrow cylindrical; those of hind leg distinctly broader, with segments 2-4 of tarsus somewhat fusiform, 5 slender (Plate xlv., fig. 6, *b*). *Hind tibia* with two small slender black spurs (Plate xlv., fig. 5, *b*), one a little shorter than the other. Order of length of segments of hind tarsus, 1, 2, 3, 5, 4; no spines present, and only very minute soft hairs. *Tarsal claws* (Plate xlv., fig. 7, *b*.) curved, sharply pointed, the inner side carrying no teeth, but convexly curved and having a series of fine, closely set hairs along its middle third; empodium curved, subtriangular, about two-fifths as long as claw.

Wings:—*Forewing* (Text fig. 1, *b*) subhyaline, slightly infuscated all over; venation black except Rs and M, which are brownish. C and R_1 stout, forming a strong anterior border to the wing. Venation almost exactly the same as in the genotype *N. hudsoni* Lamb, the only differences being that 1A fails to reach the wing-margin and 2A passes well beyond the little chitinous patch on the axillary lobe. (N.B. The venation of the pedicel of the wing of *N. hudsoni*, as given by Lamb in *Trans. N.Z. Inst.*, vol. xlv., 1913, p. 72, fig. 4, is incorrect; it should more closely resemble that shown in my Text-fig. 1, *b*). At the point *k* there is a slight kink showing where M_2 originally came off from M_{1+2}. The point *x* indicates the secondary attachment of M_4 to Cu_1 by means of the cross-vein *m-cu*, the original basal piece of M_{3+4} having become obsolete (cf. *Edwardsina*, Text-fig. 1, *a*). *Halteres* 1 mm. long, with swollen brownish base, blackish pedicel, and blackish subtriangular club.

Abdomen slender cylindrical, hairless, velvety black with slight brownish-grey pubescence; no markings. *Hypopygium* upturned, shaped as shown in Text-fig. 5, *a*, *b*, the superior processes and forceps black, with pale hairs.



Text-fig. 5:—*Neocurupira nicholsoni* n.sp. *a*, Hypopygium of ♂, dorsal view. *b*, the same, lateral view (x 50).

♀, (unique), differs from ♂ only in its slightly larger size (expanse 13.5 mm.) and in the following characters:—*Head* smaller, with much smaller blackish *eyes,* dichoptic but divided transversely; *mandibles* present. *Abdomen* much stouter than in ♂, tapering apically, blackish with plentiful grey pubescence, and ending in a pair of small, bluntly cornute appendages. The wings, damaged by immersion in water, appear to be somewhat more deeply infuscated than in the ♂.

Types:—♂ holotype, ♀ allotype and short series of male paratypes in Cawthron Institute Collection, Nelson, N.Z. A single paratype male in British Museum of Natural History, London, and another in the Australian Museum, Sydney.

Habitat:—Only found on the large waterfall on Digger's Creek, Mount Kosciusko, 4500 feet, about two miles below the hotel, and on the rapids round about it. November 28th, 1921; ten males taken by myself, and a single female found half-drowned by Mr. A. J. Nicholson. Larvae and pupae were plentiful on the rocks over which the water was running or the spray dashing heavily. The males were caught drifting up stream in sunlight along the rapids above the falls; they are very difficult to see. When alive in the pill-box, their large green eyes glow brilliantly, like those of Tabanids and certain dragonflies. One male was beaten from a bush overhanging the rapids. There is no iridescence on the wings.

This species is dedicated to Mr. A. J. Nicholson, B.Sc., F.E.S., Lecturer in Entomology in the University of Sydney, who accompanied me to Mount Kosciusko and himself took the only known female of this insect.

Genus APISTOMYIA Bigot.

(Text-fig. 1, *c.*)

Bigot, *Ann. Soc. ent. France,* (4), ii., 1862, pp. 109-114, pl. 1.

Characters as given in the Key on p. 162, with the following additions:—antennae only ten-segmented; eyes holoptic in the male, dichoptic in the female; labium very long and narrow, with the distal segments of the labellum strongly divergent; fore and middle legs rather short, hind legs long; spurs 0, 0, 2; anal angle of the wing prominent.

Genotype:—*Apistomyia elegans* Bigot (Corsica and Cyprus).

APISTOMYIA TONNOIRI n.sp.

(Plates xliv., fig. 4; xlv., fig. 1-7, *c*; Text-figs. 2, *e, f*; 6; *a-c*; 7).

♂. *Total length* 5.5, *abdomen* 4, *forewing* 5.5, *expanse* 12 mm.

Head (Text-fig. 2, *e.*) large, black, globular, almost entirely occupied by the large *eyes,* which are bright green in life, dull blackish when dead, and sometimes collapsed in the dried specimen; these eyes are holoptic, and each is divided transversely by a non-facetted line into two approximately equal portions, the upper having larger facets than the lower. *Ocellar tubercle* very small. *Antennae* (Plate xlv., fig. 1, *c.*) inserted fairly close together at the base of the narrow triangular vertex; short (0.7 mm.), black, 10-segmented, the two basal segments enlarged, the second longer than the first, the third much slenderer and only two-thirds as long as the second, 4-9 short, nearly equal, each about as wide as long, 10 nearly as long as 2, more than twice as long as 9, elongate oval with well rounded apex, 2-10 with very fine hairs. *Face* with silver-grey pubescence and hairs. *Labrum-epipharynx* about half as long as the basal segment of the labium, moderately broad, tip sharply pointed. *Hypopharynx* a little shorter, much slenderer, more sharply pointed. *Mandibles* absent. *Maxillae* (Plate xlv.,

fig. 3, *c.*) with a very short, slender and slightly curved black palpus, consisting of a single segment, and carrying a few hairs, and with a slender, pale coloured and sharply pointed galea, twice as long as the palp. *Labium* (Text-fig. 2, *e, f.*) very long and slender, black, projecting downwards and backwards more than twice the whole diameter of the head; labellum with basal segments closely approximated and connected by membrane, the distal segments diverging widely and with the distal portions curving outwards, more so in ♀ than in ♂.

Thorax velvety black, with silvery-grey markings similar to those shown in Text-fig. 7 for the female, but less conspicuous and narrower; suture between mesonotum and mesopleura more widely marked in the same colour; *scutellum* black, convexly rounded.

Legs:—Fore and middle legs rather short, the middle shorter than the fore, hind very long. Coxae and trochanters short, silvery grey pubescent; femora, tibiae and tarsi long, black; distal halves of fore and middle femora somewhat swollen, those of hind femora only slightly so. Measurements as follows:—

Foreleg:—Femur 1.5, tibia 2.3, tarsus 2.8 mm.

Middle leg:—Femur 1.5, tibia 1.7, tarsus 1.7 mm.

Hind leg:—Femur 4.5, tibia 4.5, tarsus 4 mm.

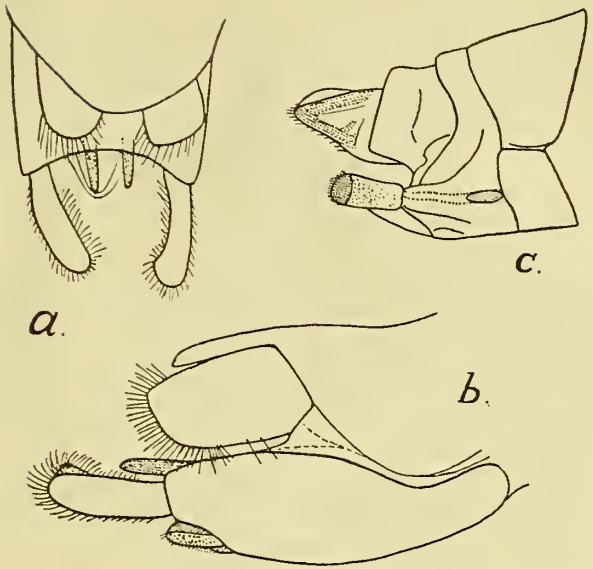
Hind tibia (Plate xlv., fig. 5, *c.*) with two equal black spurs. *Hind tarsus* (Plate xlv., fig. 6, *c.*) with the segments very long and slender, narrowly cylindrical, 1 nearly twice as long as 2; order of length of segments 1, 2, 3, 4 = 5. Inner margin of 1 bears about ten small spines, that of 2 four similar spines, and that of 3 and 4 one each. *Tarsal claws* (Plate xlv., fig. 7, *c.*) curved, black, sharply pointed, carrying on inner side about eight strong teeth, all set closely together on basal two-thirds. *Empodium* well developed, slender, about one-third as long as claw.

Wings:—*Forewing* (Text-fig. 1, *c.*) hyaline without the slightest infuscation; C and R_1 stout, jet black, forming a very strong anterior border to the wing; venation black. Venation and secondary net-veining as shown in Text-fig. 1, *c.* The venation differs from that of other members of the genus in having the short stalk of Rs from R to *r-m* obliterated, while *r-m* itself runs from M forwards as a strong oblique vein ending anteriorly on R, just before the apparent origin of Rs. Distal curvature of Rs (typical of the genus) well marked. About three fourths of the way along M_{1+2} there is always a very slight but more or less clearly marked kink (*k*), indicating the point where M_2 originally came off. The point *x* marks the secondary origin of M_4 from Cu_1, brought about by the suppression of the original basal piece of M_{3+4} and its union with *m-cu*; this point is situated only very slightly distad from the level of the axillary lobe. 1A fails to meet the wing-margin. The secondary net-veining is on the same general plan as that of *Neocurupira* and *Peritheates*, but very different from that of *Edwardsina*. *Halteres* 1 mm. long, with blackish swollen base, slender brownish pedicel, and black spatulate club.

Abdomen slender cylindrical, hairless, velvety black; seg. 1 with a transverse band of silver, complete, but very narrow mid-dorsally; 2-5 with conspicuous basal lateral silvery spots, not connected across the dorsum, rest black; sides of abdomen covered with silvery grey pubescence, underside brownish. *Hypopygium*, upturned, shaped as shown in Text-fig. 6, *a, b*, the superior processes and forceps black and hairy.

♀ slightly larger than ♂, *forewing* 6.5, *expanse* 14, *hindleg* 14 mm.

Differs from the ♂ as follows:—*Head* smaller (Text-fig. 2, *f.*), the eyes dull blackish, dichoptic, separated above by a space as broad as their combined widths; *eyes* divided transversely by a non-facetted line which cuts off a very small upper and very large lower portion; *ocellar tubercle* larger than in ♂; a



Text-fig. 6:—*Apistomyia tonnoiri* n.sp. *a*, Hypopygium of ♂, dorsal view (x 100). *b*, the same, lateral view. *c*, end of abdomen of ♀, lateral view (x 50).

large inverted U-shaped mark of silver on vertex and two small silver dots, one behind each eye, on occiput; *face* strongly marked with silver grey. *Labrum-epipharynx* and *hypopharynx* (Plate xlv., fig. 2, *c*.) half as long again as in ♂. *Mandibles* present (Plate xlv., fig. 4, *c*.), 1.2 mm. long, exceedingly slender, spear-like, sharply pointed, and carrying minute forwardly projecting barbs on the inner margin. *Abdomen* cylindrical, broader than in ♂, apex downcurved and slightly pointed; colour velvety black with the same type of pattern in silver as in ♂, but the markings larger and more conspicuous, as shown in Text-fig. 7; seg. 1 with the lateral basal spots not connected across the dorsum; seg. 6 with two silver spots. End of abdomen with a pair of subconical appendages, as shown in Text-fig. 6, *c*; *gonapophyses* of seg. 9 rather large, subconical, with dark, rounded apices carrying numerous minute hairs.

Text-fig. 7:—*Apistomyia tonnoiri* n.sp., ♀, colour pattern (x 11).

Types:—♂ holotype, ♀ allotype and four paratypes in Cawthron Institute Collection, Nelson, N.Z.; also a single paratype ♀ in British Museum of Natural History, London.

Habitat:—Weeping Rock and waterfalls below it, Wentworth Falls, Blue Mountains, N.S.W., 2800 feet. Larvae and pupae were found by myself in fair numbers on Nov. 17th, 1921. The type series of imagines was taken on Nov. 18th in the same locality, the females by myself as they drifted up against the spray of the falls or alighted on the wet rocks, the males a little later on the same day by M. Tonnoir, who accompanied me, and who observed them flying high up in bright sunshine in the spray of the waterfall, just like tiny Mayflies. Males were fairly abundant, but almost all out of reach of the net, being fifteen to twenty feet up in the air. In life, the eyes of the male glow in brilliant green, like those of *Neocurupira nicholsoni* n.sp.

This species differs from *Apistomyia collini* Bezzi, found in North Queensland, (*Bull. Soc. Entom. Ital.*, xliv., [1912], 1913, pp. 67-69), in the wings being purely hyaline instead of "slightly infuscated, with the apical spot reduced to a slight grey border," in the condition of *r-m* being fused above with R, the basal piece of Rs being absent, and also in the abdominal pattern, the silver markings not being joined as transverse bands across the dorsum as they are in *A. collini*. It appears to agree fairly closely with *A. collini* in the form of the antennae.

I dedicate this species to M. Tonnoir, the well known Belgian Dipterist, who accompanied me to the Blue Mountains on the occasion of its discovery, and himself discovered the males of the species.

In concluding this paper, I desire to express my thanks to Mr. W. C. Davies, Curator of the Cawthron Institute, for the excellent photograph of these delicate flies from which Plate xliv. has been prepared.